AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0006	14 AUG 2000		

6. ISSUED BY	CODE	7. ADMINISTERED BY *(If other than Item 6)*	CODE
US ARMY ENGINEER DISTRICT, FORT WORTH ATTN: CESWF-CT (RM 2A19) PO BOX 17300 FORT WORTH, TX 76102-0300			

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*	(X)	9A. AMENDMENT OF SOLICIATION NO.
	☒	DACA63-00-B-0023
		9B. DATED *(SEE ITEM 11)* 14 JULY 2000
	☐	10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED *(SEE ITEM 11)*
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a)By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

The Solicitation for AMMO HOT-LOAD AREA, PROJECT NO. 44921, FORT BLISS, TEXAS, is amended as follows:

See Continuation Sheet.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	16C. DATE SIGNED

Item 14. Continued.

CHANGES TO PROPOSAL RECEIPT DATE

1. Standard Form 1442, First Page, Item No. 13.A.- In the second line, change the bid opening date from "18 August 2000" to "23 August, 2000".

CHANGES TO THE SPECIFICATIONS

2. Replacement Sections - Replace the following sections with the accompanying new sections of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-00-B-0023:"

SECTION 02373 SEPARATION/FILTRATION GEOTEXTILE
SECTION 11211 PUMPS: WATER, CENTRIFUGAL

END OF AMENDMENT

SECTION 02373

SEPARATION/FILTRATION GEOTEXTILE
02/98
AMENDMENT NO. 0006

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3786	(1987) Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
ASTM D 4354	(1996) Sampling of Geosynthetics for Testing
ASTM D 4355	(1992) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1995) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1995) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(1988; R 1996) Determining the Specification Conformance of Geosynthetics
ASTM D 4833	(1988; R 1996) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(1995) Identification, Storage, and Handling of Geosynthetic Rolls

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation. Submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Manufacturing Quality Control Sampling and Testing; FIO.

A minimum of 14 days prior to scheduled use, manufacturer's quality control manual including instructions for geotextile storage, handling, installation, seaming, and repair.

Seams; FIO

Seam strength test results

SD-13 Certificates

Geotextile; FIO.

A minimum of 14 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. This submittal shall include copies of manufacturer's quality control test results. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

SD-14 Samples

Quality Assurance Samples and Tests; FIO.

Samples for quality assurance testing; 7 days shall be allotted in the schedule to allow for testing.

1.3 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

1.3.1 Delivery

The Contracting Officer will be present during delivery and unloading of the geotextile. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.3.2 Storage

Geotextile rolls shall be protected from becoming saturated. Rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic. The geotextile rolls shall also be protected from the following: construction equipment, ultraviolet radiation, chemicals, sparks and

flames, temperatures in excess of 71 degrees C , and any other environmental condition that may damage the physical properties of the geotextile.

1.3.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

PART 2 PRODUCTS

2.1 RAW MATERIALS

2.1.1 Geotextile

Geotextile shall be a woven or nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. Geotextiles and factory seams shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES

PROPERTY	TEST VALUE		TEST METHOD
Elongation at Break, percent	Less Than 50	Greater Than {AM#6}or Equal To 50	ASTM D 4632
Apparent Opening Size (AOS) (US Sieve)	0.25 mm (maximum) (No. 60 Sieve)	{AM#6}0.25 mm	ASTM D 4751
Permittivity Sec -1	0.2 (minimum)	{AM#6}0.2 (minimum)	ASTM D 4491
Grab Tensile, N	{AM#6} 1100	700	ASTM D 4632
Trapezoidal Tear, N	{AM#6} 400	250	ASTM D 4533
Burst Strength, kPa	{AM#6} 2700	1300	ASTM D 3786
Ultraviolet	50	{AM#6} 50	ASTM 4355

TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES

PROPERTY	TEST VALUE	TEST METHOD
Stability (percent strength retained at 500 hours)		

2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY CONTROL SAMPLES AND TESTS

3.1.1 Quality Control Samples

Samples shall be collected by the contractor upon delivery to the site for quality control testing in accordance with ASTM D 4354, Procedure B. Lot size for quality assurance sampling shall be considered to be the shipment quantity of the product or a truckload of the product, whichever is smaller. The unit size shall be considered one roll of geotextile. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. The outer layer of the geotextile roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 1 meter long in the machine direction. Rolls which are sampled shall be immediately rewrapped in their protective covering.

3.1.2 Quality Assurance Tests

The Contractor will provide quality assurance samples to an Independent Laboratory hired by the Contractor. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D 4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

3.2 INSTALLATION

3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section 02300 EARTHWORK .

3.2.2 Placement

The Contractor shall request the presence of the Contracting Officer during handling and installation. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes greater than 5 horizontal on 1 vertical, the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

3.3 SEAMS

3.3.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 305 mm. Where it is required that seams be oriented across the slope, the upper panel shall be lapped over the lower panel. The Contractor has the option of field sewing instead of overlapping.

3.4 PROTECTION

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 2 days during installation.

3.5 REPAIRS

Geotextile damaged during installation shall be repaired by placing a patch of the same type of geotextile which extends a minimum of 305 mm beyond the edge of the damage or defect. Patches shall be continuously fastened using an approved method. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile which cannot be repaired shall be replaced.

3.6 PENETRATIONS

Engineered penetrations of the geotextile shall be constructed as shown on the drawings or by methods recommended by the geotextile manufacturer.

3.7 COVERING

Geotextile shall not be covered prior to approval by the Contracting Officer. The Contractor shall request the presence of the Contracting Officer during covering of the geotextile. Cover shall be with drainable layed specified in Section 02714. The direction of backfilling shall proceed in the direction of down gradient shingling of geotextile overlaps.

Cover shall be placed in a manner that prevents material from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves.

No equipment shall be operated directly on top of the geotextile. A minimum of 305 mm of soil shall be maintained between full-scale construction equipment tires/tracks and the geotextile during the covering process. Compaction and testing requirements for cover soil are described in Section 02714.

-- End of Section --

SECTION 11211

PUMPS: WATER, CENTRIFUGAL
12/88
AMENDMENT NO. 0006

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM D 975	(1994) Diesel Fuel Oils

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.5	(1988; Errata Oct 1988; B16.5a) Pipe Flanges and Flanged Fittings
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15	Radio Frequency Devices

HYDRAULIC INSTITUTE (HI)

HI-01	(1983) Standards for Centrifugal, Rotary & Reciprocating Pumps

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993; Rev 1-1993) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 20	(1993) Centrifugal Fire Pumps
NFPA 30	(1993) Flammable and Combustible Liquids
NFPA 37	(1994) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(1993) National Electrical Code

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

UNDERWRITERS LABORATORIES (UL)

UL 448	(1994) Pumps for Fire-Protection Service

AMERICAN NATIONAL STANDARD ORGANIZATION

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI A21.15/AWWA C115	Cast/Ductile Iron Pipe with Threaded Flanges
ANSI 253.1	Safety Color-Code for Marking Physical Hazards
ANSI B40.1	Gages, Pressure and Vacuum

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory waterworks operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Pumps and engines of the same types shall each be the product of one manufacturer.

1.2.2 Description

The pumps shall be horizontal centrifugal water pumps of the types indicated and specified. The single driving units for the pumps shall be diesel engines as indicated and specified.

The pumps shall be horizontal centrifugal water pumps of the types indicated and specified. The single driving unit for the pump shall be a diesel engines indicated and specified. The principal items of equipment

shall include one horizontal centrifugal, engine driven pump, one liquid cooled standby engine, valves, and piping. A pump control panel with automatic liquid level control system for normal operation and internal wiring. In addition, a modular pump station enclosure shall be provided as indicated and specified.

1.2.3 Governing Requirements

Fire pumps and appurtenances shall conform in all respects to NFPA 20.

1.2.4 Safety Requirements

Gears, couplings, projecting set-screws, keys, and other rotating parts, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

1.2.5 Nameplates

Pumps and motors shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each pump shall show the capacity in liters per second at rated speed in rpm and head in millimeters of water. Nameplate for each diesel engine shall show the horsepower and the speed in rpm to produce rated output from the pump. Nameplate for each diesel engine shall show the horsepower and the speed in rpm to produce the rated output from the pump. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

1.2.6 Selection Criteria

Pumps shall be designed using hydraulic criteria based upon actual model developmental test data. Pumps shall be selected at a point within the maximum efficiency for a given impeller casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the scheduled efficiency. Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected. Acceptable maximum impeller diameter calculations shall not be based on percentage of impeller diameter range for a given casing.

1.2.7 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Contracting Officer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contracting Officer and may

be acceptable as evidence that the items conform with agency requirements.

1.2.8 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.9 Factory Tests

Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Where two or more identical pumps are specified, only one representative pump shall be tested. Certified test results shall be submitted to the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; FIO.

Manufacturer's descriptive data and technical literature, performance charts and curves for all impeller sizes for a given casing, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Centrifugal Pump System; FIO.

A complete listing of equipment and materials. Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-06 Instructions

Centrifugal Pump System; FIO.

Proposed diagrams, instructions, and other sheets, prior to posting. Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping valves, and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall

be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

Training; FIO.

Training course curriculum and training instructions shall be furnished to the Contracting Officer 14 days prior to the start of training.

SD-09 Reports

Tests; FIO.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-13 Certificates

Manufacturer's Field Representative; FIO.

The names and qualifications of the manufacturer's representative and training engineers and written certification from the manufacturer that the representative and trainers are technically qualified.

SD-19 Operation and Maintenance Manuals

Centrifugal Pump System; FIO.

Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is completed. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 216 by 279 mm (8-1/2 by 11 inches), with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:

a. System layout showing piping, valves, and controls.

b. Approved wiring and control diagrams.

c. A control sequence describing startup, operation, and shutdown.

d. Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide.

e. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified below and as shown, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

2.2 CENTRIFUGAL WATER PUMPS

The pumps shall be the centrifugal, single-stage or multi-stage type, designed for waterworks service in the following configurations:

	Pump No.
Horizontal	1

2.2.1 Pump Service

The pumps shall be utilized for the following service:

	Pump No.
Line pressure booster pump	1

2.2.2 Pump Drives

The pumps shall have the following driving units and shall be directly connected to the driving units through solid shafts, flexible couplings, or free wheeling clutches (as appropriate):

	Pump No.
Diesel engine drive	1

2.2.3 Pump Construction

Except as below specified, centrifugal water pumps shall be constructed in accordance with the Hydraulic Institute HI-01.

2.2.4 Pump Characteristics

The pumps shall be capable of discharging quantities at total discharge heads measured at the discharge flange, between the following limits:

Pump No.	Liters per second at total discharge head	{AM#6} Total Discharge Head m H(2)O
1	{AM#6} 63	93

Pumps shall operate at optimum efficiencies to produce the most economical pumping system under the conditions encountered and shall be sized to make optimum match with the system head curve as shown. Suction lift on pump No. 1 will be not more than 1,200 mm. Pumps shall furnish not less than 150 percent of rated capacity at a total discharge head of not less than 65 percent of total rated head. The shutoff total head shall be not greater than 120 percent of total rated head.

2.2.5 Pump Casings

Pump casings shall be cast iron of the following design:

	Pump No.
Horizontal shaft, horizontal split casing	1

The casings shall be designed to permit replacement of wearing parts. Horizontal-split casings shall have the suction and discharge nozzles cast integrally with the lower half, so that the upper part of the casings may be removed for inspection of the rotating parts without disturbing pipe connections or pump alignment. Pump casings shall be of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. Defects in casings shall not be repaired except when such work is approved and is done by or under the supervision of the pump manufacturer, and then only when the defects are small and do not adversely affect the strength or use of the casing. Casings shall be single or double volute with flanged piping connections conforming to ASTM 48, Class 40. The direction of shaft rotation shall be conspicuously indicated. The casing shall have tapped openings for air venting, priming, draining, and suction and discharge gauges. A brass or bronze umbrella or vent cock shall be furnished for venting except where automatic air vents are indicated. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.

2.2.6 Impellers

Impellers shall be of enclosed design and shall be constructed of bronze , carefully finished with smooth water passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft.

2.2.7 Wearing Rings

Wearing rings of bronze shall be provided for impellers. Wearing rings of a different composition or of a suitable ferrous material shall be provided

for pump casings. Casing rings shall be securely fixed in position to prevent rotation. Rings shall be renewable and designed to ensure ease of maintenance.

2.2.8 Shaft

Shaft shall be of high grade steel, accurately machined, and shall be of sufficient size and strength to perform the work required. Bronze renewable shaft sleeves shall be provided for protection of the shaft in contact with water, and in the stuffing boxes. Shaft sleeves shall be keyed to the pump shaft.

2.2.9 Stuffing Boxes

Stuffing boxes exposed to below atmospheric pressure at any operating condition, including starting, shall be provided with a water seal. Water seal shall consist of nonferrous lantern ring or a seal cage and required connections to the pump case.

2.2.10 Mechanical Seals

Mechanical seals shall be balanced or unbalanced, as necessary to conform to specified service requirements. Mechanical seals shall be constructed in a manner and of materials particularly suitable for the temperature service range and quality of water being pumped. Seal construction shall not require external source cooling for pumped-fluid service temperatures up to 120 degrees C. Seal pressure rating shall be suitable for maximum system hydraulic conditions. Materials of construction shall include AISI 300 series stainless steel, solid tungsten-carbide rotating-seal face, and Buna-N vinylidene-fluoride-hexafluoropropylene, EPT, or tetrafluoroethylene seals. Bypass flushing water supply shall be free of iron rust products and other abrasive materials and shall be directed onto face of seal without dead ending. All piping and accessories shall be provided. Throttling bushing shall have clearances to minimize leakage in case of complete seal failure without restriction of flushing water. Mechanical seals shall not be subjected to hydrostatic test pressures in excess of the manufacturer's recommendations.

2.2.11 Couplings

Couplings shall be of the heavy-duty flexible type, keyed and locked to the shaft. The outside surface of the couplings for horizontal pumps and close-coupled vertical pumps shall be machined parallel to the axis of the shaft. The faces of the couplings shall be machined perpendicular to the axis of the shaft. Disconnecting the couplings shall be accomplished without removing the driver half or the pump half of the couplings from the shaft. Couplings for vertical pumps other than close-coupled vertical pumps may be of the universal type. Flexible couplings shall not be used to compensate for misalignment of pump.

2.2.12 Balance

All rotating parts of the equipment shall operate throughout the required range without excessive end thrust, vibration, or noise. Defects of this type that cannot be eliminated by installation adjustments will be sufficient cause for rejection of the equipment. Pump impeller assemblies shall be statically and dynamically balanced to within 1/2 percent of W

times R squared, where W equals weight and R equals impeller radius. Shaft construction shall be substantial to prevent seal or bearing failure due to vibration. Total shaft peak-to-peak dynamic deflection measured by vibrometer at pump-seal face shall not exceed 0.051 mm (2.0 mils) under shutoff-head operating conditions. Flow from 8 mm (1/4 inch) iron pipe size (ips) pipe shall be provided during testing.

2.2.13 Bearings

Bearings shall be ball or roller type, and the main bearings shall take all radial and end thrust. Pumps that depend only on hydraulic balance to overcome end thrust will not be acceptable.

2.2.14 Lubrication

Bearings on horizontal-shaft pumps shall be either oil-bath type or grease type. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point. Grease type bearings shall be provided with fittings for a grease gun and, if the bearings are not easily accessible, with grease tubing extending to convenient locations. The grease fittings shall be of a type that prevent over lubrication and the buildup of pressure injurious to the bearings.

2.2.15 Base Plates

Horizontal-shaft centrifugal pumps shall be provided with a common base for mounting each pump and driving unit of the pump on the same base. Each base shall be constructed of cast iron with a raised lip tapped for drainage, or of welded steel shapes with suitable drainage pan. The drainage structure shall collect the packing box leakage and shall have a 15 mm (1/2 inch) NPT connection to connect it to a drain.

2.2.16 Cocks, Plugs, and Accessories

The pumps shall be equipped with air cocks, drain plugs, and single gauges indicating discharge pressures for all pumps. Gauges equipped with a shutoff cock and snubber shall conform to ASME B40.1, and shall be calibrated in kilopascal in not more than 13 kPa increments. Gauge ranges shall be appropriate for the particular installation. Normal operating suction and discharge pressures of the pump shall be indicated on the mid-point range of the gauges. Suction lift pipe shall be provided with a foot valve as shown, capable of preventing loss of prime when the pump rotation is stopped.

2.2.17 Piping Connections

The pump suction and discharge shall be provided with flanged connections of suitable size and suitably arranged for piping shown. Pipe flanges shall conform to ASME B16.1 and ASME B16.5. Piping shall be installed to preclude the formation of air pockets.

2.2.18 Finish

Pump shall have painted or enameled finish as is standard with the manufacturer except that fire pumps shall be red in color.

2.3 ELECTRICAL EQUIPMENT

Electrical equipment shall conform to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment herein specified shall be provided complete with motors, motor starters, and controls. Motor controls, equipment, and wiring shall be in accordance with NFPA 70.

2.3.1 Control Equipment

Automatically controlled pumps shall have three-position "MANUAL-OFF-AUTOMATIC" selector switch in cover. Additional controls or protective devices shall be as indicated.

2.4 MODULAR PUMP STATION ENCLOSURE

2.4.1 Modular Pump Station Enclosure

A. Enclosure Construction and Design:

1. The enclosure is to be square with outside dimensions of 3658 millimeter long by 3658 millimeter wide and having a maximum outside height of 2997 millimeter at the roof peak.

2. A minimum of (4) four lifting eyes arranged on the corners shall be provided to ease handling and installation onto a concrete pad furnished by the Contractor.

3. Enclosure walls and roof shall be seamless, one-piece sprayed fiberglass panels laminated to form a structural composite as follows: 3.2 millimeter thick fiberglass outside surface, 19 millimeter thick ura-foam polyurethane core, 13 millimeter marine grade plywood, and 2.4 millimeter thick fiberglass inside surface. Marine grade plywood shall replace foam at all cut-out openings and penetration points.

4. Each wall panel shall overlap at the corner and form an internal connection joint using stainless steel hardware. All panel joints shall be thoroughly sealed with silicone caulk. The enclosure shall have a minimum R-10 insulation factor and shall be capable of withstanding 240 kilometers per hour.

5. All exterior surfaces shall be stucco textured (green, tan, white, light blue, or grey colored) isopthalic gel coat finish incorporating ultra violet inhibitors.

6. All interior surfaces shall be strayed white isopthalic get coat finish offering the same characteristics as the exterior surfaces.

7. The roof panel shall be an arched, one-piece design incorporating the same materials of construction as the side walls. The roof shall be removable as a unit, allowing for complete access to the pumping equipment with a crane. The pitch of the roof shall be sufficient for good moisture drainage.

8. The 915 millimeter wide x 2030 millimeter high entrance door(s) shall be constructed of the same laminated fiberglass and foam core

materials as the remainder of the station. Marine grade plywood will replace the insulation in areas where auxiliary equipment will be mounted. Each door shall be hung with (2) two stainless steel ball bearing type hinges. A three point closure system incorporating a lockable door handle and interior override lever shall allow emergency exits even if the door is padlocked from the outside. An adjustable door positioner and holder shall be mounted to withstand 240 kilometers per hour winds. A wall mounted drip molding will be installed above each door.

9. After the pumping equipment is installed, the fully assembled station enclosure shall be positioned on the concrete mounting pad and sealed with butyl autoglass tape as furnished by the pump station manufacturer. The interior base flange shall be drilled positioning and fastened to the pad using expansion anchors on 610 millimeter maximum centers.

B. Enclosure Functional Equipment:

1. The interior of the station shall be illuminated by factory installed 120 volt, 40 watt, two (2) lamp fluorescent light fixtures providing two (2) watts illumination per square foot. All lights will be prewired and run to the control panel through PVC conduit and a weatherproof switch shall be installed adjacent to each station entrance. A length of flexible conduit shall provide for quick connection of the lighting circuit to the pump control panel. The lighting circuit shall be protected by a thermal-magnetic control breaker.

2. A thermostatically controlled 120 VAC exhaust fan with screen and weatherproof shutters shall be installed in the wall approximately opposite the fresh air intake vent. The fan shall have a minimum capacity of 1600 CFM at free air and be capable of changing the air in the enclosure a minimum of six times per hour. The exhaust fan shall be protected by a thermal-magnetic circuit breaker.

3. Two (2) self-contained, unpowered, thermally actuated fresh air intake vents shall progressively open or close exterior louvers as a result of thermal expansion or contraction of a wax-like material contained in an enclosed plunger actuator. Movement for the plunger rod shall drive the louver vane mechanical linkage. The louvers will progressively open at 24 degrees C, and progressively close at 15.5 degrees C. Operation of the intake louvers shall not require use of motors, solenoids, or other electrically related devices. The plunger actuator shall be mounted out of the incoming air flow, and shall hold the louvers fully open based on the ambient temperature of the pump station interior. The louver vanes and frame shall be constructed of anodized aluminum, with zinc plated steel actuator mounting and linkage. The louver vanes shall pivot on plastic bearings.

4. Two (2) unpowered, thermally actuated exhaust vents shall be supplied for each engine used. The louvers will progressively open at 75 degrees F, and progressively close at 60 degrees F. Operation is the result of thermal expansion or contraction of wax in an enclosed plunger which is used to drive the louver vane mechanical linkage. Functional operation is identical to the intake vents, except the plunger actuator is mounted directly in the path of the air flow in order to sense the ambient temperature of the air exiting the pump station interior.

5. A critical grade spiral muffler and flexible exhaust pipe will be supplied for each engine. The pump station enclosure shall incorporate provisions for installation of the exhaust equipment through the wall panel.

6. The pump control panel for the Auto-start Pump Station shall be shipped completely prewired to the pumps, motors, and engine(s) through conduit secured to the pump base. Upon installation, the Contractor shall remove any temporary shipping hardware and brackets, and anchor the control panel permanently to the concrete station pad.

7. A battery back-up 12 volt DC emergency lighting system shall provide 50 watts of illumination for 1 1/2 hours in the event of power outage. The system shall be fully self-contained for automatic operation of (2) sealed beam lamps powered by a maintenance free pure-lead 12 volt battery. An automatic solid state battery charger with integral transfer circuit shall maintain the battery in a constant state of readiness. A charge rate pilot light and test switch shall be provided. The charging circuit shall be protected by a thermal-magnetic circuit breaker.

8. The pump station enclosure shall incorporate an optional insulation package which increases the standard R10 insulation rating to R20 by doubling the thickness of the ura-foam polyurethane core in the wall and roof panels.

9. The station enclosure shall be furnished with extra wide doors. A double hung door design with 3-point locking hardware, door closer, and hinges on each section shall allow complete access to the 6'-0" x 6'-8" full door opening without the need for a center sill.

10. A wall mounted duplex GFI utility receptacle providing 120 volt AC power shall be installed and prewired through PVC conduit with the station lighting. The receptacle shall be protected by thermal magnetic circuit breaker.

2.5 VALVES AND PIPING

A. Check Valves: Check valves shall have ductile iron body with Buna-N liner. Aluminum bronze or ductile iron disc plates and dual stainless steel internal springs. Check valve bodies shall be designed for installation between ANSI B16.1 Class 125 flanges. Swing check valves requiring reversal of flow for closure shall not be acceptable.

B. Isolation Valves: Isolation valves shall be butterfly type with resilient seat designed for installation between ANSI B16.1 Class 125 flanges. Valves shall have cast iron body with Buna-N liner. Ductile iron disc with one piece stainless steel shaft and PTFE bushings.

C. Pump Control Valve: The booster pump control valve shall be designed for installation on the discharge of booster pumps to eliminate starting and stopping surges caused by the pump. The valve shall be equipped with a built-in lift type check feature to prevent reverse flow, operating independently of the solenoid control and shall be comprised of the following:

1. The valve shall be hydraulically operated, single diaphragm actuated, globe or angle pattern. A resilient synthetic rubber disc shall

have a rectangular cross section and shall be retained on three and one-half sides to assure proper gripping under extreme hydraulic conditions. The two piece stainless steel valve stem shall be guided by three bearings located in the cover.

2. The main valve shall consist of two distant operating chambers that are detachable and completely independent of the flow through the main valve body.

3. The valve shall consist of four components: the body with seat installed, the power unit body with center bearing, the cover with the bearing installed, and the diaphragm assembly. The valve body, power unit body and cover shall be of cast material. Ductile iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process. The diaphragm assembly shall be the only moving part and shall form a seal between the two operating chambers. Packing glands and/or stuffing boxes are not permitted. There shall be no pistons operating the main valve or pilot controls. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one piece design capable of withstanding line shocks due to abnormal pump stoppage. No hourglass-shaped disc retainers shall be permitted and no V-type disc guides shall be used.

4. The diaphragm assembly containing a non-magnetic two piece stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided by three bearings; in the valve cover, the power unit body, and an integral bearing in the valve seat. The built-in lift type check is designed to prevent pressure reversal caused by power failure. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary.

5. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 41 bar per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity.

6. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

7. The main valve seat, the power unit body and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 1.64 millimeter and small size valves shall be threaded into the cover and body. The valve seat in 200 millimeter and larger size valves shall be retained by flat head machine screws for ease of maintenance. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. All necessary repairs and/or modifications other than

replacement of the main valve body shall be possible without removing the valve from the pipeline. Components, including cast material, shall be of North American manufacture.

8. The valve manufacturer shall warranty the valve to be free of defects in material and workmanship for a period of three years from the date of shipment provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one-year warranty.

9. The valve manufacturer shall be able to supply a complete line of equipment from 50 millimeters through 400 millimeter sizes and a complete selection of complementary equipment.

10. Pilot Control System: The valve operation shall be controlled by an externally mounted pilot control system with a four-way solenoid operated pilot. The solenoid shall be designed to operate on either AC or DC current and have a manual operator installed. Pilot system includes: four-way solenoid pilot valve, opening and closing speed controls, shut off valves, strainers and CVS-1 shuttle valve to provide the highest available operating pressure to the pilot system.

11. Limit Switch: An adjustable limit switch assembly shall be mounted on the main valve, connected to the main valve stem. It shall be actuated by opening or closing of the valve and easily adjusted to operate at any point of the valve's travel. The limit switch will be used to complete the pump off cycle. The actuating point of the limit switch shall be adjustable. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

D. Paddle Type Flow Switch. The flow switch shall meet the following requirements:

1. Maximum temperature: 121C (Liquid), 85 C (ambient)
2. Maximum pressure: 31 bar
3. Materials:
   a. Paddle: SS316
   b. Bellows: SS321
   c. Housing: NEMA 4
4. Micro switch: SPDT, 220V, 8A, 1700 VA
5. Cable length as required for construction. Cable length determined by Contractor.
6. Orientation: Horizontal flow
7. Pipe size: 8"
8. NPT connection: 1"

E. Piping:

1. Flanged header pipe shall be centrifugally cast, ductile iron, cement lined, complying with ANSI/AWWA A21.51/C115 and Class 53 thickness.

2. Flanges shall be cast iron class 125 and comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within 1/2 degrees

between flanges. Flanges shall be faced with a gasketed finish having concentric grooves a minimum of 0.25 millimeter deep by approximately 0.76 millimeters wide, with a minimum of three grooves on any given surface spaced a maximum of 6 millimeters apart.

F. Service Saddles for Ferrous Metal Piping

1. Iron service saddles shall be used for the installation of the flow switch. Service saddles shall be capable of withstanding 10 bar internal pressure without leakage or overstressing. The run diameter shall be compatible with the outside diameter of the pipe on which the saddle is installed. Taps shall have threads compatible with the attached piping. Saddles shall have epoxy-coated, ASTM A 536 ductile-iron bodies and stainless steel straps, steel hex nuts with washers, and neoprene seals.

2. Corporation stops shall be installed for each service saddle and shall be ball-valve-type.

G. Supports and Thrust Blocks:

1. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force mainpiping shall be anchored with thrust blocks where shown on the contract drawings.

2.6 DIESEL ENGINES

Diesel engines shall be water-cooled, heavy duty, compression-ignition, cold-starting engines with removable cylinder sleeves. Engines may be 2-cycle or 4-cycle and may be either naturally aspirated, scavenged or turbocharged and shall operate satisfactorily on No. 2D diesel fuel conforming to ASTM D 975. Engines shall be provided with a manual clutch and arranged for connection to the pump through a flexible shaft with a splined joint. Engines shall be current models of a type in regular production and shall be complete with all devices specified and normally furnished with the engine. Engines shall have a published continuous horsepower rating at least 150 percent greater than that required at any point on the pump performance curve at the specified pump speed plus power required for any engine driven accessories. Naturally aspirated ratings shall be decreased by 3 percent for every 300 m of altitude, and 1 percent for every 5 degrees C that the engine performance conditions exceed the published rating conditions. Scavenged or turbocharged engine ratings shall be decreased as indicated by the engine manufacturer's engine performance data. Engine shall be suitable for performance at 49 degrees C (120 degrees F) ambient and 3000 mm (10 ft) elevation. Engine speed shall not exceed 1,800 rpm when driving the pump at rated conditions. Engines shall be capable of starting and assuming full load within 10 to 15 seconds, with a minimum ambient temperature of 4.5 degrees C (40 degrees F). Approved engine jacket water heaters shall be provided as recommended by the manufacturer.

2.7 ENGINE EQUIPMENT AND ACCESSORIES

2.7.1 Governor

Engine shall be equipped with an adjustable constant speed governor set to maintain pump speed within 3 percent of rated speed at rated load. A separate, manual reset, overspeed device shall be provided which shall shut down the engine in the event the speed reaches approximately 15 percent above rated speed.

2.7.2 Cooling System

Cooling system shall be the forced-circulation, closed type and shall include a fan and an engine mounted radiator. Flexible connections shall be used to connect the inlet and outlet radiator connections to the engine. Radiator shall be of sufficient capacity to operate the engine at full rated load at 49 degrees C (120 degrees F) ambient temperature. Radiator shall be provided with a flange for connection to the exhaust air duct. Closed jacket water circuit shall be thermostatically controlled, and shall include an integral circulating pump. Drain cocks shall be provided at low points of the closed jacket water system. Exhaust manifolds shall be water jacketed or provided with an insulating jacket furnished by the engine manufacturer. Engine cooling system shall be charged with an inhibited ethylene-glycol solution to provide antifreeze protection to 4.5 degrees C (40 degrees F).

2.7.3 Lubrication

Engine lubrication shall be a pressure circulation system with an engine driven pump and engine mounted oil cooler. Full flow type filters with automatic bypass or bypass type filters shall be provided. Filter elements shall be of replaceable type and shall be readily accessible.

2.7.4 Exhaust System

Engine exhaust system shall be equipped with an industrial type silencer with drains and flexible, stainless steel connection. Flexible connector shall be provided with factory fabricated expanded metal personnel protection guards. Silencers shall be mounted outside as indicated and shall be of the straight through, or side inlet type as required to suit the space available and the engine exhaust arrangement. An engine with dual exhaust outlets and provided with one exhaust silencer shall have dual inlets on the silencer or a factory fabricated Y-branch or equivalent fitting to join the two exhausts together.

2.7.5 Air Intake Equipment

Each engine shall be provided with a dry cleanable type intake air cleaner. Filter shall be engine mounted.

2.7.6 Starting Equipment

Engine shall be provided with an electric starting motor suitable for the starting service specified.

2.7.7 Batteries

Each engine shall be provided with heavy-duty nickel-cadmium alkaline or lead acid type starting batteries. Batteries shall have sufficient

capacity at 4.5 degrees C (40 degrees F) to provide the necessary cranking speed through 15 minutes of cranking cycles specified. Batteries shall be provided with a battery rack, and if material is not inherently resistant to acid, coating shall be applied to the stand. Connecting cables shall be provided as required. A dual battery set sized to NFPA 20 requirements with rack and cables shall be provided for fire service systems.

2.7.8 Battery Charging

Engine shall be equipped with an engine driven battery charging alternator with a regulator for use when the engine is running. A separately mounted battery charger shall also be furnished. Battery charger shall be an automatic, float type providing continuous taper charging. Output characteristics shall match the requirements of the battery furnished. Charger shall be suitable for operation on 240 volt, single-phase, 60 Hz current and shall be rated not less than 6 amperes dc. A dual battery charger of proper type for batteries used shall be provided for fire service systems. Where wall mounting is indicated, enclosure shall be suitable for conduit connection, and ventilating openings shall be guarded. An interlock is required between the engine driven charging system and the charger. Battery charger shall have the following features:

a. Direct current voltage regulation shall be within plus or minus 2 percent for variations in line voltage of plus or minus 10 percent.

b. Direct current voltmeter and direct current ammeter, each with numerical scales.

c. Automatic surge suppressor.

d. Automatic current limiting to prevent overloading due to engine cracking, shorted output or reversed battery connections.

e. Alternating current line fusing.

f. Equalize charge rate with manually set timer.

g. Integral protection to prevent battery discharge through the charger on loss of alternating current line voltage.

h. Terminal block with terminals for all external connections.

2.7.9 Safety Controls

Each engine shall be equipped with automatic shut down features to stop the engine for high jacket water temperature, low oil pressure, and engine overspeed. Shutdown features shall be connected to the annunciator on the instrument panel and each shutdown feature will be identified.

2.7.10 AUTOMATIC ENGINE CONTROL PANEL

A. A combination manual and automatic type controller with "manual-Off-Automatic" selector switch shall be provided also, a 115 volt single phase power failure relay or a pressure switch, which will (when the system drops to set point psig) activate all electrical circuits to automatically start the engine.

B. Should the engine fail to start after the required cranking cycles,the controller shall disconnect the starting circuit and activate an alarm system using lights and buzzer and bell. "Low oil pressure" and "high engine temperature" shall also be indicated by a suitable alarm system. The engine shall not shut down if either of these conditions occurs during an operating cycle.

C. The engine shall be started automatically by the controller at least once a week and operate a minimum of 30 minutes. An appropriate timing arrangement shall determine the day and hour of this test.

D. Starting the engine by a flow switch relay shall be included in the controller circuit.

2.7.11 ELECTRICAL CONTROL COMPONENTS

A. The electrical control components shall be provided by the pump station supplier and shall be provided with the following features.

B. Panel Enclosure

1. Enclosure shall be constructed in conformance with applicable section of National Electrical Manufacturers Association (NEMA) standards for Type 1 electrical enclosures. Enclosure shall be fabricated of steel having a minimum thickness of not less than 2 millimeter (14 gauge). All seams shall be continuously welded, and shall be free of burrs and voids. Interior and exterior surfaces shall be white enamel. There shall be no holes through the external walls of the enclosure for mounting the enclosure or any components contained within the enclosure. Panel enclosure up to 1524 x 915 x 305 millimeters shall be mounted on floor stands and secured to pump base.

2. Enclosure shall be equipped with a door mounted on a continuous steel hinge, and sealed around its perimeter. Door shall be held closed with clamps that are quick and easy to operate. The door shall accommodate the mounting of switches and indicators.

3. Enclosure shall be furnished with a removable back panel, fabricated of steel having a thickness of not less than 2.7 millimeter (12 gauge) which shall be secured to the enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components.

4. All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. Self-tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks.

5. Six digit elapsed time meters (non-reset type) shall be connected to each pump motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".

6. A duplex ground fault indicating utility receptacle providing 115 VAC, 60 hertz, single-phase current shall be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15-ampere

thermal-magnetic circuit breaker.

7. Indicating lights shall be oil tight type and equipped with integral step-down transformers for long lamp life. Lamps shall be incandescent type rated 14 volts or less. Lamps shall be replaceable from the front without opening the control panel door and without the use of tools. Indicating lights will be provided for the following functions:

a. Pump #1 high pump temperature shutdown
b. High wet well level
c. Alarm silenced
d. Pump #1 run
e. Engine low oil pressure
f. Engine high temperature
g. Engine overspeed
h. Engine overcrank
i. 115 volt power available
j. (Low water alarm optional)

2.7.12 Fuel System

Fuel system consisting of storage tank, day tank, connecting piping, and accessories shall conform to the applicable items of NFPA 30 and NFPA 37. A horizontal underground storage tank with a capacity of 1135 liters (300 gallons) shall be provided for the storage of No. 2 diesel fuel. The storage tank shall be a base mounted integral fuel tank.

2.8 EQUIPMENT APPURTENANCES

2.8.1 Attachments

All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment. Bolts shall conform to the requirements of ASTM A 307 and nuts shall be hexagonal of the same quality as the bolts used. Threads shall be clean-cut and shall conform to ASME B1.1. Bolts, nuts, and washers specified to be galvanized or not otherwise indicated or specified, shall be zinc coated after being threaded, by the hot-dip process conforming to ASTM A 123 as appropriate. Bolts, nuts, and washers specified or indicated to be stainless steel shall be Type 316.

2.8.2 Equipment Guards

Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

2.8.3 Tools

A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary

for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. One pressure grease gun for each type of grease required for diesel engines shall also be furnished. All tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

2.8.4 Shop Painting

All motors, pump casings, and similar parts of equipment customarily finished in the shop shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Ferrous surfaces not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

PART 3 EXECUTION

3.1 INSTALLATION

Each pump and engine shall be installed in accordance with the written instructions of the manufacturer and under the direct supervision of the manufacturer's representative. Engine fuel supply system shall be installed as indicated and in conformance with NFPA 30 and NFPA 37.

3.1.1 Concrete Foundations

Concrete for equipment foundations and for any required ballast for fuel storage tanks shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. Concrete foundations shall be integral with and of the same class as that of the building floor unless otherwise indicated. Concrete having a compressive strength of at least 17 MPa shall be used in foundations that are entirely separated from the surrounding floor. A premolded filler strip shall be installed between the foundation and floor slab as shown. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.

3.2 TESTS

After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. The Contractor shall make arrangements to have the manufacturer's representatives present when field equipment tests are made. Each pumping unit shall be given a running field test in the presence of the Contracting Officer for a minimum of 2 hours with each combination of electric motor and engine drive. Each pumping unit shall be operated at its rated capacity or such other point on its head-capacity curve selected by the Contracting Officer. The Contractor shall provide an accurate and acceptable method of measuring the discharge flow. Each engine shall be operated for a minimum of 4 hours at a point of maximum horsepower indicated on the pump head-capacity curve or such other point on the curve selected by the Contracting Officer. For submersible pumping units, an insulation resistance test of the cable and the motor shall be conducted prior to installation of the pump, during installation of the pump, and after installation is complete. The resistance readings shall not be less than 10 megohms. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable

heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

3.3 FIELD PAINTING

Stainless steel, galvanized steel, and nonferrous surfaces shall not be painted.

3.3.1 Touch-Up Painting

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and topcoated with the manufacturer's standard factory finish.

3.3.2 Exposed Ferrous Surfaces

Exposed ferrous surfaces shall be painted with two coats of enamel paint conforming to SSPC Paint 21. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed with one coat of SSPC Paint 25 or in accordance with the enamel paint manufacturer's recommendations.

3.4 MANUFACTURER'S FIELD SERVICES

The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment. Up to 2 days service shall be provided at no expense to the Government.

3.5 DEMONSTRATION

Upon completion of the work and at a time designated by the Contracting Officer, the services of one or more competent engineers shall be provided by the Contractor for a period of not less than 8 hours to instruct a representative of the Government in the operation and maintenance of equipment furnished under this section of the specifications. These field instructions shall cover all the items contained in the bound instructions.

-- End of Section --